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# *Ecosystem Management and Livestock*

Part 2 of USAID's 2011 Summer Seminar #2:

***“A Greener Revolution – Improving Productivity and Increasing Food Security By Enhancing Ecosystem Services”***

**Joyce Turk**

Bureau for Food Security

**Walter Knausenberger**

Bureau for Africa/Sustainable Development Office

**Michael Colby**

EGAT Bureau/Natural Resources Management Office

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## **Livestock is the fastest growing agricultural sub-sector.**

- Population growth plus rising urban incomes driving escalating global demand for Animal Source Foods. (ASF = meat and dairy products)
- Pastoralists worldwide, and Brazil, are meeting much of this demand. (USDA, 2010; MacDonald & Simon, 2011-a, -b, -c)
- Increasing competition for land – livestock feed cultivation (corn, soy) versus mobile grazing. (Schneider, 2011)



Photo – Six goats browsing on bushes amid patches of grass and bare soil, in Naivasha, Kenya (by Joyce Turk, USAID).



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## Some indicators of livestock's importance

- Grasslands and browse (the basis for livestock production) cover about **70% of global agricultural area**.
- Economic value of livestock is **up to 50-80% of [agricultural] GDP** in some countries. (World Bank, 2007, as cited in Neely et al., 2009)
- Of **880 million rural poor** people living on less than \$1/day, **70%** are partially dependent on livestock for livelihoods and food security. (World Bank, 2007a; Neely et al, 2009)



Photo – A dozen Samburu men tending a large herd of goats in grass/forest mosaic near Nanyuki, Kenya (from Laikipia Wildlife Forum website banner, with their logo “Laikipia Wildlife Forever” [www.laikipia.org/](http://www.laikipia.org/) )



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## The Big Challenge: a paradigm shift

- Common perception: livestock cause damage to ecosystems. Not necessarily: **mismanagement** is the issue.
- Livestock productivity depends on ecosystem services – water and nutrient cycling to grow grass, browse, and other fodder (rangeland productivity).
- Managed properly, livestock can also help **generate** the ecosystem services they need to flourish in rangelands, conservation agriculture, and agro-forestry systems.
- The keys are *mobility and focus on vegetation quality*.





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## Rangeland ecosystem services

- Mineral & nutrient cycling – incl. storing **30% of world's soil carbon**
- Water cycling/storage – grass/vegetative cover can capture **50-80% more water** than bare ground
- These reduce flood and drought risk, and enhance security of agriculture and fisheries downstream.



Three photos by C. Leggett, depicting some key rangeland ecosystem services.

Left: grass (primary production) converting solar energy & facilitating water capture.

Center: animal dung for nutrient cycling. Right: small stream for water cycling and storage.



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## Pollination services

- **Bees** (and other valuable pollinators) in rangelands
- produce high value honey,
- while pollinating trees and shrubs that yield pods, an important livestock browse.

Top photo – White box beehive strung between two acacia trees in mosaic landscape, Laikipia, Kenya (by Walter Knausenberger, USAID).

Bottom photo – Close-up of honeybee approaching lavender flower (from Laikipia Wildlife Forum website, with logo “**Laikipia Wildlife Forever**”)

[www.laikipia.org/](http://www.laikipia.org/)





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## Livestock in national & local economies - Africa

- **Chad**: pastoral animals provide over 33% of exports, plus feeding 40% of domestic population.
- **Ethiopia**: **US\$121** Million – #2 export as of 2006, plus domestic consumption.
- **Kenya**: pastoralists' domestic livestock valued at **US\$800** Million per year, **35%** of agricultural GDP.
- **Mali**: exported live animals worth **US \$44.6** Million (2006).
- **Niger**: **76%** of the national herd are pastoral cattle.

Source: de Jode/IIED & SOS Sahel UK, 2009.

*(See accompanying photo next slide...)*





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## Livestock in national & local economies - Africa



Photo - Maasai pastoralists in traditional red garb tend their cattle in the evening boma after a day of grazing (by Joyce Turk, USAID).





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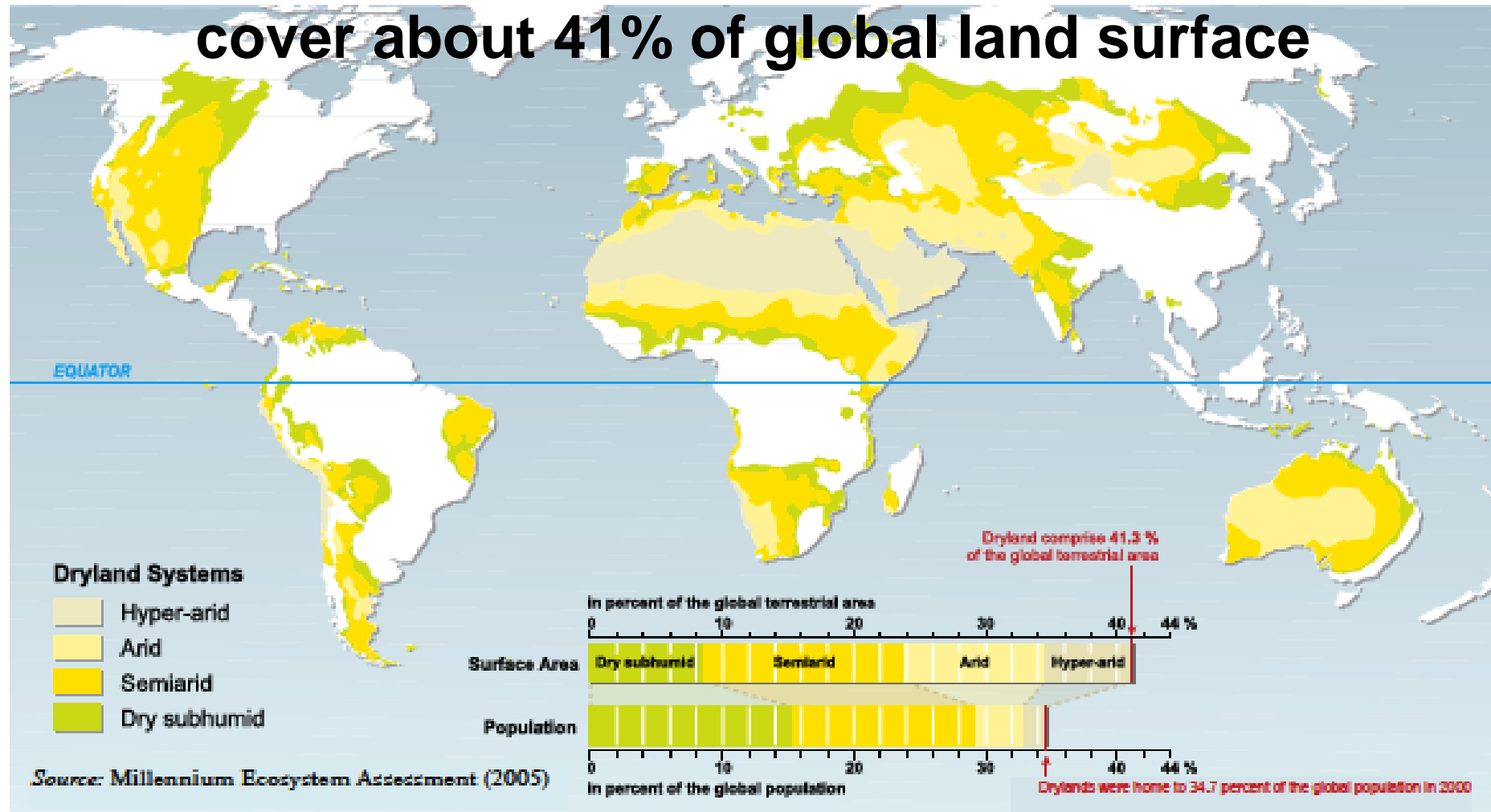
## Global demand driving risky production strategies

- **Brazil** is now the **#1 beef & poultry exporter**, with 2<sup>nd</sup> largest cattle herd, mostly grass-fed (207 million head in 2005; USDA, 2009, 2010).
- Brazil's **land-extensive approach** to cattle expansion is its biggest driver of deforestation, responsible for **½ of Brazil's GHG emissions** (Bustamente et al, 2009), with one of the lowest pasture productivity/stocking rates in world. (Landers, 2007)
- ~One third of **China's feed** for ½ of world's pork production from conversion of Brazil's Cerrado (savannah) & Amazon rainforest to **soy** (+ one third from US). Brazil now world's **#2 soy producer**. (MacDonald & Simon, 2011a,b; Schneider, 2011; USDA 2010)
- Cattle are often just a **transition stage between rainforest and soy**. ***Neither is sustainable!*** (droughts, receding water table)



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## Drylands are home to over 2 billion people, cover about 41% of global land surface



*Figure 1: Distribution of the world's drylands according to aridity zones (based on UNEP, 1992).*



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## Drylands and Grasslands

- **65% of global** dryland area is grassland used for livestock production by **~800 Million** people. (Mortimer et al, 2009)
- These lands have potential for sequestering an additional **~1 Billion tons** of carbon per year. (Neely et al., 2009; IPCC, 2007)
- Drylands cover **43% of Africa's** surface, much of it dedicated to pastoralism. (de Jode/IIED & SOS Sahel, 2009)
- **~50 Million** pastoralists plus **200 Million** agro-pastoralists live in Africa's drylands. (de Jode/IIED & SOS Sahel, 2009)

*(See accompanying photo next slide...)*



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## Drylands and Grasslands



Photo - Samburu landscape north of Isiolo, Kenya: plains of tall dry season (tan) grass, scattered acacia trees, Matthews Mountain Range, and hazy sky in background (by Walter Knausenberger, USAID).





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## Arid/Semi-Arid Land (ASAL) Pastoralism



Left photo – Two camels browsing dense brush in arid northern Kenya (by Joyce Turk, USAID).

- **Largest land use system** in world, well adapted to climate change (along with wildlife) - due to **mobility**. (MEA, 2005)
- **Pastoralist systems are 3-10 times more productive** than fixed ranching systems in drylands using Total Economic Valuation (Rodriguez, 2008; IIED & SOS Sahel, 2009; COMESA, 2010; WISP 2008).

Right photo – A dozen Samburu women in dress garb (from Laikipia Wildlife Forum website, with logo “Laikipia Wildlife Forever” [www.laikipia.org/](http://www.laikipia.org/) )





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## Co-evolution of Pastoralism & Grasslands

- Most dryland systems are ecologically grazing-dependent.  
(McNaughton, 1979a & 1979b)
- Reducing mobility or excluding grazers can actually damage ecosystem health and stability. (Savory & Butterfield, 1999)
- *PASTORALISM with WILDLIFE is the most economically viable, environmentally sustainable, and climate-resilient production system for dry grasslands.*

(Mortimer et al, 2009; de Jode/IIED & SOS Sahel UK, 2009; Rodriguez, 2008; WISP 2007, 2008; COMESA 2010)

*(See accompanying photo next slide...)*



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## Co-evolution of Pastoralism & Grasslands



Photo - Tall, mid-season (light green) grass with cattle and three Samburu herdsmen in foreground, and wild buffalo herd on hill with more trees in background.  
On Il Ngwesi Conservancy in Laikipia District, Kenya (by Walter Knausenberger, USAID).





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## Rangelands: food and water security



- Provide about **23% of meat**, and **27% of milk** production **globally**.  
(AFORNET, 2005)
- Milk, meat, blood, leather, fiber are **by-products of rangeland management**.
- **Aquifers recharged** through water infiltration in well-managed rangelands.

Photo – Samburu warrior sitting in tall, dry grass (by Michael Colby, USAID).





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## “Grass to Cash”

- Actually more than just grass; includes shrubland, pasture, and cropland intercropped with trees, & other fodder crops.
- **Livestock are a means of converting what we can't eat into something we can.**
- **Key is maintaining the quality of vegetation, which requires disciplined grazing and mobility.**



Photo – Recently harvested bundles of 6 foot tall Sudan Grass, near the Dawa River, Mandera District, NE Kenya (by Walter Knausenberger, USAID).



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## Livestock + crops + ecosystem services

- **Brazil–Cerrado** (savannah): *Integrated Crop-Livestock Zero Tillage (ICLZT)*: 4-8 year rotation system, zero tillage nitrogen fixing crops (soy, etc.) – more profitable than crops or cattle alone, restoration of degraded pastures allows for sustainable intensification and reduced deforestation.

(Landers/FAO, 2007; Dehue et al, 2010)

- **South Dakota: ICLZT**  
as above, plus **organic**.  
(USDA/NRCS, Ray Archuleta video, USDA Soil Health Series video)

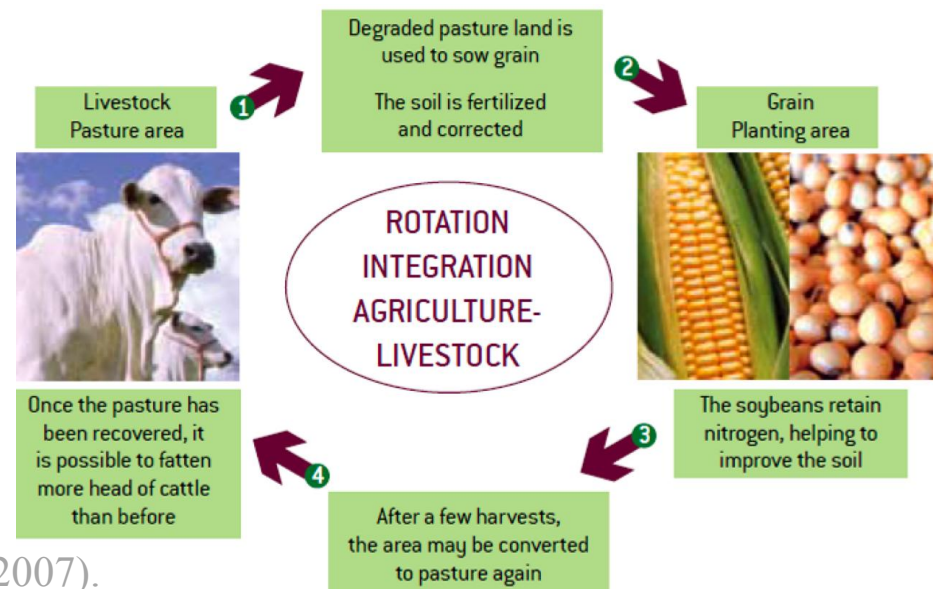


Diagram – depicting restorative rotation of soy & corn with cattle (from Dehue et al., 2010; ABIOVE, 2007).



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## More examples of integrated programs

- **Brazil–Pantanal**: quick dry season rotational system on wetter, native pasturelands: **2-6 times** the productivity of traditional ranching (Eaton et al./WCS, 2011)
- **Brazil**: *Forest-Crop-Livestock Integration (BIOME* low carbon agriculture program)
- **Mongolia**: Gobi – Livestock Early Warning System (LEWS) – forage monitoring (Angerer et al., 2009 a & b)
- **India**: National Action Plan on Climate Change promotes pasture development and livestock as alternate source to crops-only based livelihoods.



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## Re-greening Sahel: Livestock are part of the story

- **5 Million hectares** in Niger & Mali by ***Farmer Managed Natural Regeneration (FMNR)*** of nitrogen-fixing *Faidherbia* trees; increased both crop and fodder productivity.
- *‘Gao is good fodder for our family livestock, and pastoralists also appreciate the fodder.’*
- *‘We want more trees; and **we need more animals for regenerating the trees.**’*



Right photo – Small cattle fattening operation, based mainly on pods of field trees (left photo). [From presentations at USAID by McGahuey & Mahamane, 2011]







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## East Africa: livestock + wildlife = income + food

- **Tanzania** – Maintenance of **grazing reserves** *also* provides critical dry season habitat for wildlife: contributes estimated US\$8 Million to Tanzania's northern circuit tourism industry, income that enhances local access to food. (Nelson, 2009)
- **Kenya** (Samburu) – *Northern Rangelands Trust & Laikipia Wildlife Forum* using livestock as a tool to help rehabilitate degraded land. (Northern Rangelands Trust, 2011; Grevy's Zebra Trust, 2011; Laikipia Wildlife Forum, 2011)

Photo: Il Ngwesi group ranch community grazing planning meeting, Laikipia, Kenya (by R. Hatfield).





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## Southern Africa examples

Namibia, Zambia & Zimbabwe –  
**planned grazing, moving** animals  
through pre-defined grazing areas in a  
coordinated, **intensified** pattern.

- Biggest impact in seasonal rainfall environments where large herds of wild herbivores co-evolved with grasslands.
- **Livestock can be used to try to mimic the role these herds once played in maintaining ecosystem health.**

(Savory & Butterfield, 1999)



Upper Photo - cattle being herded using Guy Glosson's low-stress herding technique.



Lower Photo - Cattle exiting overnight boma (both photos by Constance Neely).



# Livestock can improve rangeland quality by planned and bunched grazing



2004



2005

9/2005: Improvement (some grass) after cattle impact, despite severe **failure** of 2004-2005 rains.

9/2004: 30+ years of bare, physically-crusted soil, preventing water infiltration & grass germination.

In September 2004, a boma (overnight animal enclosure) was placed on site for just one week, before the rainy season (usually November to March).



2006

9/2006: Further recovery of grass after **good** '05-06 rains.



2007

Cattle are now grazed in groups through the watershed, supporting 300% more animals than before. Community brings in animals to save them in periods of drought.

9/2007: Good condition, despite severe **failure** of '06-07 rains.





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## Holistic Resource Management & Rangelands

- Most pastoralists traditionally seek to follow nature's model of intense, short period/rotational grazing that maximizes sustainable productivity. (Savory & Butterfield, 1999)
- Pastoralists know how to manage grazing to heal the land with livestock, simultaneously increasing resiliency against drought, building biodiversity, and improving livelihoods. (Northern Rangelands Trust, 2011; Grevy's Zebra Trust, 2011; Laikipia Wildlife Forum, 2011)
- Responses to droughts such as sedentarization around boreholes lead to a breakdown in mobility, overwhelming carrying capacity, and “desertification.”





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## PARADIGM SHIFT

- Management = huMAN-agement.
- Rangeland productivity depends on ecosystem services + animal mobility.
- Livestock can and do provide positive ecosystem services when properly managed.



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# ASF FtF

## Animal Source Foods Feed the Future



Photo - Maasai cattle herd on rocky ridge in northern Rift Valley, Kenya (by Joyce Turk, USAID).

# References

ABIOVE (Brazilian Association of Vegetable Oil Industries), 2007. “Understanding the soy moratorium: responsible production.” Available from [http://www.abiove.com.br/english/sustent/ms\\_cprodutor\\_24jul07\\_us.pdf](http://www.abiove.com.br/english/sustent/ms_cprodutor_24jul07_us.pdf)

AFORNET, 2005. “The Forestry-Livestock Interface – Lessons learnt on Sustainable Forest Management in Africa, Policy Brief Number 7” -- Royal Swedish Academy of Agriculture and Forestry (KSLA), African Forest Research Network (AFORNET) at the African Academy of Sciences (AAS), and FAO.

Angerer, Jay, Sean Granville-Ross, Doug Tolleson, 2009a. “Technology Transfer Part I: Implementation of the Livestock Early Warning System in Mongolia.” Global Livestock CRSP, Research Brief 09-01-GOBI, Univ. of California-Davis.  
<http://glcrsp.ucdavis.edu/publications/?project=gobi>

Angerer, Jay, Sean Granville-Ross, Doug Tolleson, 2009b. “Technology Transfer Part 2: The Voice of LEWS: Information Outreach from the Gobi Forage Livestock Early Warning System.” Global Livestock CRSP, Research Brief 09-02-GOBI, Univ. of California-Davis. <http://glcrsp.ucdavis.edu/publications/?project=gobi>

Archuleta, Ray (USDA, Natural Resources Conservation Service), Video presentation, <http://vimeo.com/channels/raythesoilguy>

Bustamente, Mercedes, C. Nobre, R. Smeraldi, 2009. “Estimating recent emissions from cattle raising in Brazil.” Amigos de Terra-Amazonia Brasileira, National Institute for Space Research, University of Brasilia; Sao Paulo.

COMESA, 2010. “Modern, Mobile and Profitable: Assessing the Total Economic Value of Pastoralism.” Common Market for Eastern and Southern Africa, Comprehensive African Agriculture Development Programme, POLICY BRIEF Number 13, February. <http://www.google.com/search?client=safari&rls=en&q=“Modern,+Mobile+and+Profitable”&ie=UTF-8&oe=UTF-8>

Dehue, B., van de Staiij, J. and Chalmers, J., 2010. *Mitigating indirect impacts of biofuel production: Case studies and Methodology*. A report for the UK Renewable Fuels Agency. Ecofys, Netherlands.



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## References, page 2

de Jode, Helene (ed.)/IIED & SOS Sahel UK, 2009. *Modern and Mobile: the future of livestock production in Africa's drylands*. International Institute for Environment & Development (IIED) & SOS Sahel International UK.

<http://pubs.iied.org/pdfs/12565IIED.pdf>

Eaton, DP, SA Santos, MCA Santos, JVB Lima, A Keuroghlian (Wildlife Conservation Society), 2011. "Rotational Grazing of Native Pasturelands in the Pantanal: an effective conservation tool." *Tropical Conservation Science*, Vol. 4 (1): 39-52,

[www.tropicalconservationscience.org](http://www.tropicalconservationscience.org).

FAOSTAT, 2011. <http://faostat.fao.org>

Grevy's Zebra Trust, 2011 (website). "Changing the way we think about livestock." <http://www.grevyszebratrust.org/range-management.html>

IIED & SOS Sahel UK, 2009. *Modern and Mobile: the future of livestock production in Africa's drylands*. International Institute for Environment & Development (IIED) & SOS Sahel International UK. <http://pubs.iied.org/pdfs/12565IIED.pdf>

IPCC, 2007. "Climate Change 2007: Mitigation." Contribution of Working Group III to the Fourth Assessment Report for the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK & New York.

Knausenberger, Walter, 2010. "Presentation: Dryland Pastoral Systems & Climate Change: Implications and opportunities for mitigation and adaptation," USAID East Africa, 1 February 2010, at USAID /AFR Workshop on Planning for Climate Change Investments in East Africa, Nairobi.

Laikipia Wildlife Forum website, 2011. <http://www.laikipia.org/> (Nanyuki, Kenya)

Landers, John N., 2007. "*Tropical crop-livestock systems in conservation agriculture: the Brazilian experience*." Integrated Crop Management, Vol. 5. Food and Agriculture Organization, Rome. <http://www.fao.org/docrep/010/a1083e/a1083e00.htm>



## References, page 3

Mahamane, Larwanou, 2011. “Management of Trees on Farm in Niger: Experience and Way Forward,” African Forest Forum, presentation at USAID, Washington, January 2011.

MacDonald Mia, & Justine Simon, 2011a. “Cattle, Soyanization, and Climate Change: **Brazil’s** Agricultural Revolution.” Brighter Green, New York. <http://brightergreen.org/brightergreen.php?id=24>

MacDonald Mia, & Justine Simon, 2011b. “Skillful Means: The Challenges of **China’s** Encounter with Factory Farming.” Brighter Green, New York. . <http://brightergreen.org/brightergreen.php?id=24>

MacDonald Mia, & Justine Simon, 2011c. “Climate, Food Security, and Growth: **Ethiopia’s** Complex Relationship with Livestock.” Brighter Green, New York. . <http://brightergreen.org/brightergreen.php?id=24>

McGahuey, Michael, 2011. USAID Agriculture Sector Council presentation, “Increasing and Sustaining Dryland Agricultural Productivity Through Management of Natural Resources,” May 20, 2011.

McNaughton, S.J., 1979a. “Grazing as an optimization process: grass-ungulate relationships in the Serengeti.” *Amer. Nat.*, 113: 691-703.

McNaughton, S.J., 1979b. “Grassland-Herbivore Dynamics” Chapter 3 (pp. 46-81) in Sinclair, A.R.E. & M. Norton-Griffiths (eds.), 1979, *Serengeti: Dynamics of an Ecosystem*. Univ. Chicago Press, Chicago & London.

Millennium Ecosystem Assessment – Drylands, 2005.

<http://www.millenniumassessment.org/documents/document.291.aspx.pdf>

Mortimore, M. with contributions from S. Anderson, L. Cotula, J. Davies, K. Facer, C. Hesse, J. Morton, W. Nyangena, J. Skinner, and C. Wolfangel, 2009. *Dryland Opportunities: a new paradigm for people, ecosystems and development*, IUCN, Gland, Switzerland; IIED, London, UK and UNDP/DDC, Nairobi, Kenya. x + 86p. <http://pubs.iied.org/pdfs/G02572.pdf>



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## References, page 4

- Neely, Constance, Sally Bunning, Andreas Wilkes, 2009. *Review of evidence on drylands pastoral systems and climate change: Implications and opportunities for mitigation and adaptation.* (Land and Water Discussion Paper #8). FAO, Rome.  
[http://www.fao.org/uploads/media/LWdisc\\_paper8\\_temp.pdf](http://www.fao.org/uploads/media/LWdisc_paper8_temp.pdf)
- Neely, Constance & Caterina Batello, 2011. “*Presentation: Integrated Pastoral and Agro-Silvo-Pastoral Systems in the Drylands.*”
- Nelson, F, 2009. “Natural Conservationists? Evaluating the impact of pastoralist land use practices on Tanzania’s wildlife economy.” IIED and TRNF.
- Northern Rangelands Trust (website), 2011. <http://www.nrt-kenya.org/home.html> , <http://www.nrt-kenya.org/livestock.html>
- Rodriguez, Luis, 2008 “A Global Perspective on the Total Economic Value of Pastoralism: Global synthesis report based on six country valuations.” World Initiative for Sustainable Pastoralism (WISP), IUCN, Gland.  
[http://data.iucn.org/wisp/documents\\_english/TEV\\_Eng.pdf](http://data.iucn.org/wisp/documents_english/TEV_Eng.pdf)
- Savory, Allan, & Jody Butterfield, 1999. *Holistic Management: A new framework for decision making.* 616 pp., Island Press, Washington, DC. Or see <http://www.savoryinstitute.com> and <http://www.holisticmanagement.com>
- Schneider, Mindi, 2011. “Feeding China’s Pigs: Implications for the Environment, China’s Smallholder Farmers, and Food Security.” Institute for Agriculture and Trade Policy (IATP), May. <http://www.iatp.org/files/FeedingChinasPigs.pdf>
- USDA (U.S. Department of Agriculture), 2009. “Agricultural Economy and Policy Report—Brazil,” February.  
<http://www.fas.usda.gov/country/Brazil/Brazil%20Agricultural%20Economy%20and%20Policy.pdf>
- USDA (U.S. Department of Agriculture), 2010. “Livestock and Poultry: World Markets and Trade.” Foreign Agricultural Service, October. [http://www.fas.usda.gov/dlp/circular/2010/livestock\\_poultryfull101510.pdf](http://www.fas.usda.gov/dlp/circular/2010/livestock_poultryfull101510.pdf)



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## References, page 5

USDA Soil Health Series Video: <http://vimeo.com/channels/healthysoilshhealthycrops>

WISP, 2007. *Global Economics of Pastoralism*, World Initiative for Sustainable Pastoralism, IUCN, Gland.  
<http://www.iucn.org/wisp/>

WISP, 2008. “Forgotten Services, Diminished Goods: understanding the agroecosystem of pastoralism.” WISP Policy Note #8, World Initiative for Sustainable Pastoralism, IUCN, Gland. [http://data.iucn.org/wisp/documents\\_english/WISP\\_PN8\\_en.pdf](http://data.iucn.org/wisp/documents_english/WISP_PN8_en.pdf)

World Bank, 2007a. *World Development Indicators*. Washington, DC.

World Bank, 2007b. *World Development Report 2008: Agriculture for Development*. Washington, DC.